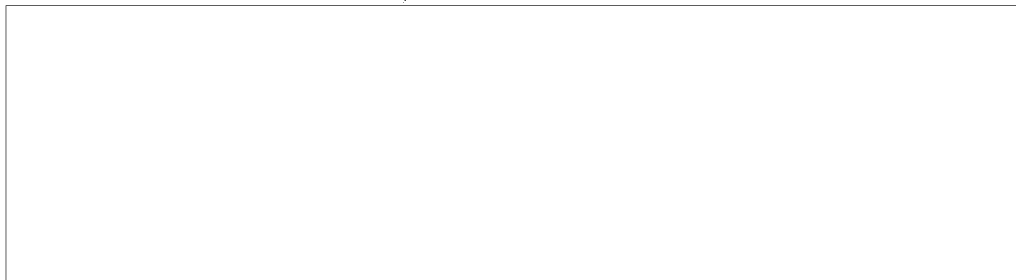


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COUNTRY : USSR

SUBJECT : TACTICAL MISSILE AND ARTILLERY COLLECTION:
"Principles of the Employment of Chemical
Missiles"

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The Collection is intended for generals and officers, from artillery division commanders and higher, and for the commanding officers of independent tactical(takticheskaya) missile battalions.

Use and study of the Collection is also permitted generals and officers of the headquarters of districts, army corps, divisions, and military educational institutions having a direct interest in the problems dealt with and the appropriate clearance.

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The book consists of 64 numbered pages plus one insert between pages 58 and 59.

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Technical Editor N. A. Bukovskaya Proofreader A. P. Bubnova

Type Set 21/7/61

Sent to press 26/8/61

Format of paper 60 x 90 1/16 - 4 qr. = 4.0 conditional qr plus one

Insert = 3/8 qr. = 0.1875 conditional qr.

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Publication No. 6/289 (Top Secret)

Principles of the Employment of Chemical Missiles

Under modern conditions, chemical weapons with toxic (otravyayushcheye) chemical agents of extremely high toxicity (toksichnost) are one of the most powerful means of destroying the enemy. The primary means for utilizing this weapon are missile large units (units).

Missile large units (units) can deliver chemical strikes against objectives located in both the operational and tactical depths, under any conditions of the anti-aircraft defense of these objectives. In addition, missile large units (units), as opposed to other means, ensure the delivery of sudden chemical strikes, as the most effective ones, leading to mass losses in the enemy's troops.

There are substantial peculiarities in the use of chemical missiles, as compared with the use of missiles with nuclear or conventional charges. For this reason, commanders and staffs of the missile troops and artillery must know the combat characteristics of missiles with chemical charges and know how to use them in a battle and in an operation.

Combat Characteristics of Chemical Missiles

Chemical missiles usually have charges of highly toxic chemical agents of the VR-55 type, which injure enemy personnel not only through the breathing organs but also by minuscule drops through the skin. Therefore it is possible to inflict mass losses on enemy personnel.

After the burst (opening) of a chemical missile in the atmosphere, the toxic chemical agent is split up by the stream of air it encounters and, in the form of minuscule drops, fog and vapors, it is carried by the wind and falls to the surface of the earth.

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The main factor in the firing of chemical missiles is the size of the area to be contaminated by drops of the toxic chemical agents, in which practically instantaneous annihilation (porazheniye) of enemy personnel is achieved. In addition, enemy personnel can also be annihilated by vapors and fog from the toxic chemical agent beyond the limits of the sector contaminated by drops of the toxic chemical agent (otravlyayushcheye veshchestvo - OV). The depth to which the vapors of the OV spread, depending on the meteorological conditions, the relief of the terrain, and the conditions of use may fluctuate within considerable limits (from 2 to 20 km). Under conditions of convection and isothermy, annihilation by vapors is possible only in the area immediately adjacent to the sector contaminated by drops of the OV.

It shall be kept in mind that together with the annihilation of personnel by the toxic chemical agents, the terrain, clothing, equipment, armament and combat equipment are contaminated, which will require the enemy to carry out thorough degasification of the contaminated armament and equipment and necessary regroupings of troops, because the destructive action of the drops of the toxic chemical agent remains on the terrain within the limits of 1 to 3 calendar days.

Thus, by the use of chemical missiles, besides accomplishing the primary mission, which is annihilation of personnel, the operations of the enemy are paralyzed and the maneuverability of his troops is reduced.

The size of the area contaminated by drops of the toxic chemical agent depends on the amount of this agent in the missile, the velocity of the missile at the time of the burst, the height of the missile burst above the objective to be destroyed, and the velocity and direction of the wind.

The area contaminated by one chemical missile normally has the shape of an ellipse, elongated in the direction of the vector of

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the average wind in the sector, and from the height of the burst of the missile to the surface of the ground; the greater the wind velocity the more elongated the ellipse of the contaminated area in the direction of the wind.

The relationship of the large and small axes of the ellipse of the contaminated area, depending on the height of the missile burst and the velocity of the wind, can be from 5 to 1 to 10 to 1 or more, i. e., for the R-170 missile the ellipse may be 3000 to 5000 meters long and 700 to 500 meters wide; for the R-30 missile correspondingly it is 2400 to 3400 meters and 500 to 400 meters.

The density of contamination of the terrain in the burst of a chemical missile is not the same over the entire area. The greater density of contamination is created close to the center of the missile burst, as a result of the settling of heavy drops of the toxic chemical agent. The density of contamination becomes less as one moves away from the center.

The most advantageous height of burst of a missile, by which the maximum territory is contaminated by drops of the OV, is not less than 400 meters for the R-30 missile and not less than 1500-2000 meters for the R-170 missile. Losses from drops of the OV may be 80 percent of the personnel for an R-30 missile used on an area of about 90 hectares and an R-170 missile used on an area of 200 hectares. In addition, on an area 3 to 5 times greater than that indicated above, over 15 percent of the enemy's personnel may be contaminated by vapors of the toxic chemical agent.

Objectives for Destruction by Chemical Missiles

Missiles with chemical charges may be used for annihilating and neutralizing enemy personnel independently and in combination with other means of destruction, primarily with nuclear/missile weapons. Chemical missiles are used against those objectives that are not destroyed by nuclear weapons, and also in those cases when destruction is not desired in the directions of the operations of friendly troops.

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Objectives for destruction by chemical missiles are selected keeping in mind the combat characteristics of the chemical weapon, the antichemical and antinuclear protection of these objectives, the missions of friendly troops and the nature of the use of other means of destruction.

Annihilation by drops of the toxic chemical agent is most effective when delivering a strike against enemy personnel in the open. Therefore, the objectives for strikes by chemical missiles may first of all be concentrations of enemy troops on terrain which is unprepared or insufficiently prepared from the engineer standpoint. For example, enemy reserves in concentration areas and troops at river crossings may be considered to be such objectives. Calculations show that units of an enemy tank division will not have shelters for personnel and combat equipment for 3 to 5 hours after arriving in a concentration area. Subsequently, for roughly 1 to 2 days, the part of the personnel which is occupied with additional engineer preparation of the concentration area will also be located outside the shelters. It follows that strikes with chemical missiles against the enemy in a concentration area may be delivered and be effective during a prolonged period of time.

After the engineer preparation of the concentration area, strikes by chemical missiles, despite their lower effectiveness, are possible for annihilating enemy personnel engaged in the servicing of combat equipment and other work in preparation for combat operations.

An important role should belong to chemical missiles in the destruction of enemy nuclear weapons, because in an operation these weapons are the first priority objectives for destruction by all weapons capable of combatting them.

Enemy units and subunits having weapons of nuclear attack, are dispersed, prior to their use, in waiting areas which, as a rule, are prepared from the engineer standpoint with various types of shelters. A large part of the personnel of these units and subunits, when located in the areas indicated, will be sheltered. This situation leads to the inadvisability of using chemical missiles against enemy nuclear weapons when they are located in waiting areas.

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In the areas of launching (firing) positions, collective means of protection are usually unavailable. When preparing missiles for launching at indicated positions, the personnel are located outside shelters. Therefore, the use of chemical missiles against areas of launching (firing) positions when the enemy's nuclear weapons are located there, is most effective.

An "Honest John", "Lacrosse" and "Little John" battalion deploys in combat formation on an area of 1.5 to 2 square kilometers. In delivering a strike with chemical weapons, it can be considered to be one objective, with the expenditure of one, and less often, two, missiles. With one R-30 chemical missile, with a flank (in relation to the front of the battalion) wind, a large part of his combat formation will be destroyed with drops of the OV. When the wind is perpendicular to the front of the battalion, one missile can destroy up to one platoon and partially destroy other subunits.

A battalion of 280 mm guns or 203.2 mm howitzers deploys in combat formation on an area 4 to 5 km along the front and up to 2 to 3 km in depth, while the firing positions of the batteries are located on an area of 1 to 1.5 square kilometers. On the basis of this, it is advisable to take the batteries as objectives for destruction. In this case, in order to destroy a battalion, up to three R-30 chemical missiles may be required.

A battalion of "Corporal" or "Redstone" guided missiles on launch sites, in a siting area, occupies an area 6 to 8 by 6 to 8 km. In delivering strikes with chemical missiles, it can be considered as two objectives. The firing battery will be the most vulnerable and it can be covered with drops of OV from the burst of one R-170 chemical missile. In order to destroy the other elements of the combat formation of the battalion, one more missile may be required.

A group of "Matador" or "Mace" cruise missiles (samolet-snaryad) deploys in combat formation on an area up to 30 km along the front and 20 km in depth. The most vulnerable elements of the group are the launching sites at which the personnel are located outside shelters for a period of about 1.5 hours when preparing for a strike.

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Enemy control points are important objectives for chemical missile strikes. Measures undertaken by the enemy to organize antiatomic defense (protivoatomnaya zashchita-paz) and antichemical defense (protivokhimicheskaya zashchita-PKhZ) of control points do not fully save them from destruction by chemical weapons, especially during highly maneuverable combat operations. It is advisable to carry out the firing of chemical missiles against major control points such as the command posts of large units and formations and the control points of air defense (PVO).

The airfields of the enemy's tactical aviation may also be located within the range of operational-tactical chemical missiles. It is advisable to time strikes against them for the moment when aircraft are taking off and landing, when the flight and engineer-technical personnel will not be in shelters.

Thus the main objectives for strikes by chemical missiles may be:

For tactical missiles:

- "Little John", "Honest John" and "Lacrosse" type battalions (batteries);

- 203.2 mm howitzer and 280 mm gun battalions (batteries);

- reserves and combat groups of the divisions of the first echelon army corps;

- firing positions of artillery and antiaircraft missiles that are within range.

For operational-tactical missiles:

- "Corporal", "Redstone" and "Sergeant" type battalions;

- battalions of antiaircraft guided missiles (zenitnaya upravlyayemaya raketa-ZUR) "Nike" and "Nike-Hercules";

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-corps and operational reserves of the enemy;

-major control points;

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-airfields.

For strikes by chemical missiles, major objectives are picked first, in order to utilize fully the destructive characteristics of the OV. The minimum size of the objective may be 1.5 to 2 km along the front and in depth. In destroying such an objective with one chemical missile, 50 percent or more of the enemy's personnel is put out of action. In this, the total area contaminated by drops and vapors of the OV, on which annihilation of personnel is achieved, is about 54 percent. If the size of the objective is greater than the indicated norms or if a greater degree of destruction is required, then a strike can be delivered against it with several chemical missiles.

The approximate expenditure of chemical missiles for the destruction of certain objectives is shown in Table 1 (on the average 30 percent of the sheltered and 50 to 60 percent of the unsheltered personnel are put out of action).

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TABLE 1

Objectives for Destruction	Number of Missiles	
	Tactical	Operational -Tactical
A battalion (battery) of "Honest John", "Little John", or "Lacrosse", a battery of 280 mm guns and 203 mm howitzers	1-2	1
A "Corporal" type battalion at the launch site	1-2	1-2
A tank battalion	1-2	1
A combat group in a concentration area.....	4-5	2-3
A division command post	1-2	1
A division in a concentration area	---	10-15*
An airfield	---	2-3
* The expenditure indicated is for the destruction of all units of the division. In individual cases, it will be advisable to inflict only partial destruction with 3 to 4 missiles.		

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Methods of Using Chemical Missiles

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The greatest results can be achieved by the delivery of a simultaneous and sudden chemical strike against the objective to be destroyed. When a simultaneous strike against an objective is impossible, successive strikes may be delivered.

Taking into consideration that when firing a chemical missile the toxic chemical agent is carried downwind, the point of aim must be removed a certain distance from the center of the target, to the side opposite the direction of the wind (diagram 1). The distance the point of aim is moved out depends on the height of the burst of the warhead (boyevaya chast) of the missile, the velocity of the missile at the moment of the burst, and the velocity of the wind, and is determined for each specific case.

The distance between points of aim in the direction of the wind must be less than the length of the larger axis of the ellipse of the contaminated sector, and in the direction perpendicular to the direction of the wind--not less than the lesser axis of the ellipse of the contaminated sector.

The determination of the aiming points in firing with chemical missiles is carried out in the missile large unit (unit). With this purpose in mind, in assigning missions to commanding officers of missile large units (units), the sizes and shapes of the objectives to be destroyed are indicated. When several missile units are brought in to fire on one objective, and also when there is a threat of contaminating friendly troops, the aiming points may be determined by the chief of the missile troops and artillery of the army, by the chief of artillery of the division, or by their staffs.

Taking into consideration the considerable depth to which the air contaminated with toxic chemical agent spreads, and also the stability of OV of the VR-55 type, it is advisable to deliver chemical missile strikes against the most distant objectives in the enemy's

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territory, especially if the wind is in the direction of friendly troops. It is advisable to destroy objectives located in direct contact with friendly troops with chemical ammunition from tube and rocket artillery.

Chemical weapons may be used in an operation when the troops are accomplishing various combat missions.

In an offensive, chemical missile strikes may be delivered during the preparation for the offensive, in a meeting engagement, when repelling enemy counterstrikes (counterattacks), when committing the second echelons to combat, during a swift breakthrough of defensive lines which have been hastily occupied by the enemy in the operational depth, and for the annihilation of encircled enemy groupings.

In preparing for an offensive, chemical missiles are used to destroy reserves, major command posts and the nuclear weapons of the enemy which are located in the depth of the defense.

In order to achieve surprise, when preparing for an offensive, it is advisable to deliver a chemical missile strike simultaneously with a nuclear strike. The objectives which are destroyed by chemical missiles must be located not closer than 5 to 10 km from the objectives which will be subjected to nuclear strikes, in order to preclude scattering of the OV by the agitation of the air mass from the nuclear burst. If it is impossible to carry out a simultaneous strike, then the chemical missile strike may be delivered when necessary and expedient, immediately after the nuclear strike, during the course of the offensive.

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Key

- H_r - the height of the missile burst
- S_k - the area of actual contamination by drops of OV
- S_p - the area on which contamination by vapors of the OV is achieved with a level of intensity of not less than medium
- S_n - the drift of the center of the contaminated sector from the ground zero of the missile burst
- Δ_{gr} - the density of contamination by drops of OV on the borders of the sector (0.03 to 0.06 grams per square meter)

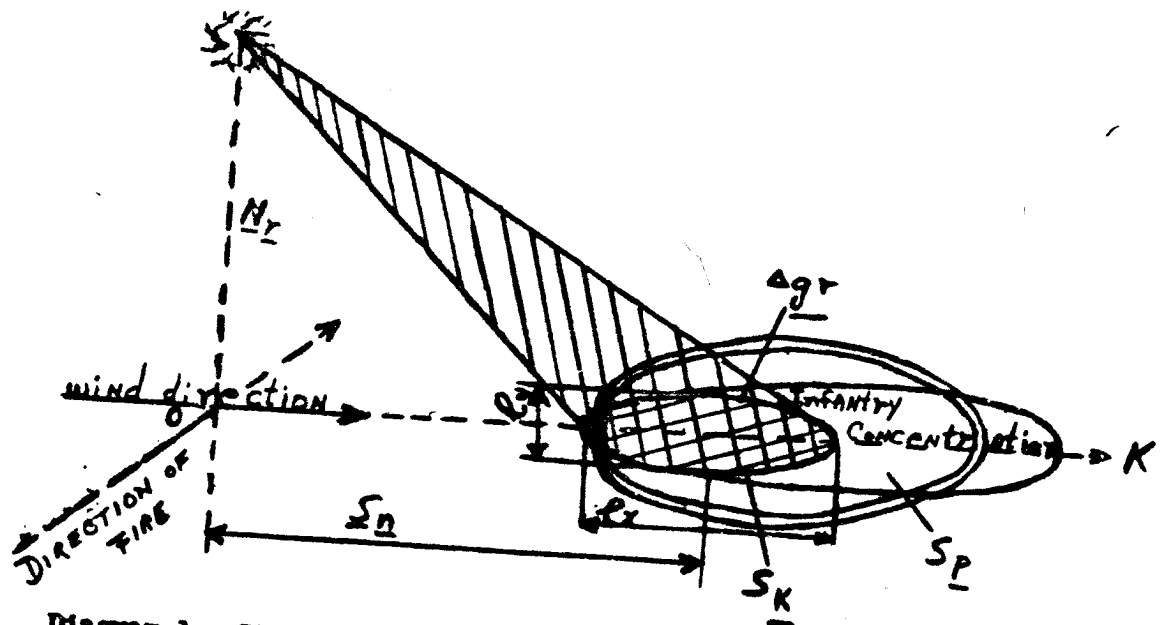


Diagram 1 - The position of the aiming point in relation to the objective to be destroyed.

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When destroying enemy nuclear weapons, it is possible to make use of chemical missiles in combination with air strikes and, within the limits of its range, with artillery fire. In this, it is advisable to use air strikes and tube artillery fire with high-explosive fragmentation shells immediately after the chemical missile strike, with the aim of annihilating the enemy personnel who are occupied with eliminating the results of the chemical attack.

During an offensive, the primary objectives for destruction by chemical missiles will be newly discovered nuclear weapons of the enemy reserves, and other important targets. Strikes against enemy reserves are delivered when they are located in their concentration areas or when they are moving out of these areas, and also when deploying for a counterstrike.

When a meeting engagement arises in the course of an offensive, chemical missiles may be used for the destruction of a strike grouping of troops, nuclear weapons, and approaching enemy reserves at places of their possible concentration (river crossings, defiles, and others).

In order to limit the maneuver of the enemy on the main routes of movement of his troops, together with the annihilation of personnel, contaminated zones may be created at important road junctions, at river crossings and in other narrow places. In addition, chemical missiles may be used to prevent (limit) the work of important rear services installations.

When seizing enemy defensive lines swiftly and also when committing second echelons to combat, chemical missiles may be used against the nuclear weapons of the enemy, strongpoints and junctions on the axes of operations of our troops, against command posts, and other important objectives.

In defense, chemical missiles may be used for destroying the same objectives as in an offensive, when delivering strikes with the aim of disrupting enemy offensives, as well as during a defensive battle.

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Planning the Use of Chemical Missiles

The use of chemical missiles is planned to be simultaneous with the use of missiles with nuclear charges, taking into consideration the properties of the toxic chemical agents, the peculiarities of the objectives to be destroyed, the wind at the location of the objective, and the safety of friendly troops.

Chemical missiles are normally used in a centralized manner according to the plan of the army (front).

The commander of the army (front) makes the decision to use chemical weapons, in which he determines: the target for the use of chemical weapons; the distribution of chemical missiles according to troop tasks; the order and time for delivering a strike with chemical missiles in combination with nuclear strikes, artillery fire and air strikes, during the preparation for an operation and during its course; the reserve of chemical missiles. In this, tactical chemical missiles are used according to the plan of the army only for the accomplishment of the most important missions of the operation: when preparing for an offensive, when committing the second echelons to combat, for the destruction of enemy reserves and for repelling his counterstrikes. In all the other cases, especially in the course of an offensive when troops are operating on separate axes, tactical chemical missiles are used at the discretion of the division commanders.

The chief of missile troops and artillery, together with his staff, in accordance with the decision of the army (front) commanders, carries out the planning of the use of chemical missiles by missile units and large units, which includes: the determination of the volume of fire mission for the missile large units and units and the distribution of objectives for destruction among them; the determination of the expenditure of chemical missiles against each objective (target); the determination of the order and time for delivering a strike with chemical missiles, taking into consideration the time when the nuclear strikes will be delivered; the determination of the

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level and duration of contamination of the terrain in the area of the objective to be destroyed and the possible enemy losses, and also the determination of the safe distance for friendly troops from the objectives which are destroyed with chemical weapons.

Success in using chemical missiles depends, to a large extent, on the organization of reconnaissance of the enemy and on the meteorological support of the missile troops.

In support of the use of chemical missiles, reconnaissance must determine the nature of the disposition of enemy personnel in objectives designated for destruction and the places where the concentration is greatest; the condition of the antinuclear and anti-chemical protection of the enemy objectives; the dimensions of the objectives (along the front and in depth), the nature of the terrain in their location and the presence of vegetation cover, which influences the protection of enemy personnel from drops of the toxic chemical agent.

A task of the meteorological service, besides resolving general questions necessary for the use of missiles with any type of charge, will be the determination of meteorological conditions in the area of the target at the time when the chemical missile strike is delivered and after the strike. In this, most important is the determination of the wind velocity and direction in the sector from the height of the missile burst to the surface of the ground in areas where the objectives to be destroyed are located. This mission can be partially accomplished by aviation. In addition, the velocity and direction of the wind in the area of the objectives to be destroyed by chemical missiles may be determined from the data in the meteorological bulletin "Meteorocket" ("Meteo-reaktivnyy"), within the limits of its validity. This question should be thoroughly studied at forthcoming exercises and in combat firings by missile units.

The adoption of measures for the safety of friendly troops when firing with chemical missiles is conditioned by the stability of the OV in the contaminated sectors and their ability to spread under the in-

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fluence of the wind to considerable distances from the points of burst of the chemical missile.

The stability of the OV depends on the meteorological conditions and the vegetation cover in the area of the target, and also on the degree of breaking up of the OV into drops. It may vary, as indicated above, within the limits of one to three calendar days. Areas contaminated by OV of the VR-55 type can be crossed by our troops, in individual protective equipment, immediately after delivery of the strike.

However, taking into consideration the great stability of the OV on the terrain, it is necessary in planning the use of chemical missiles always to consider the tasks and directions of operations of the troops. To avoid a decrease of the tempo of the offensive, it is advisable to select objectives to be destroyed by chemical missiles to the side of the movement of friendly troops but, when this is not possible, to select sectors to be contaminated with OV which can be easily bypassed by the troops.

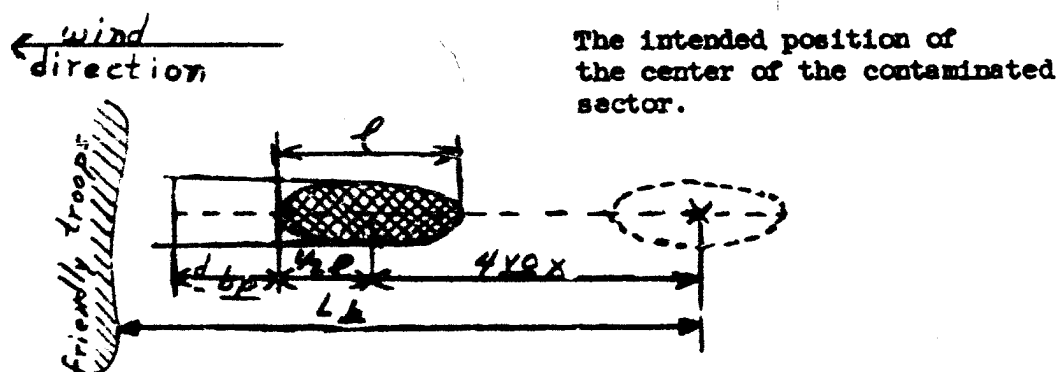


Diagram 2. Safe distance of friendly troops when firing chemical missiles.

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In order to preclude the destruction of friendly troops, the objectives to be destroyed by chemical missiles must be selected at a distance that is safe for troops. The safe distance (Diagram 2) is determined in all cases with consideration for the meteorological conditions, in particular the velocity and direction of the wind at the moment of firing.

It can be determined by the formula:

$$L_b = 1/2 l \sqrt{4 VO \sqrt{d_{bp}}}$$

- Where:
- L_b - safe distance;
 - l - the depth of the sector of terrain contaminated with drops of the OV (axis of the ellipse) in the direction of friendly troops; when meteorological conditions are unstable the value of the longer axis of the ellipse is used;
 - VO - the probable deflection of the center of the sector contaminated by drops of the OV from the intended position;
 - d_{bp} - the depth of the spread of OV vapors with toxic doses which will put out of action personnel in gasmasks.

The value of the probable deflection is determined by special tables, taking into consideration errors in the determination of the height of burst of the missile and the velocity and direction of the wind, and the resultant errors in the preparation for the firing (taking into consideration the technical dispersion of the missile and errors in the preparation of data). The approximate values of the probable deflections in the firing of the chemical R-30 missile are set forth in Table 2. (The wind direction coincides with the plane of fire.)

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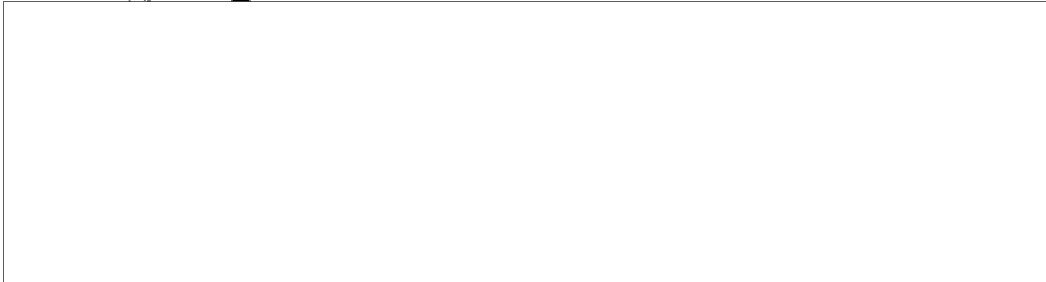
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Table 2

Height of missile bursts in meters	Speed of the missile at the moment of the burst in meters per second	Average wind velocity in meters per second					
		2		8		14	
		\underline{VO}_y	\underline{VO}_x	\underline{VO}_y	\underline{VO}_x	\underline{VO}_y	\underline{VO}_x
400	400	157	163	238	164	356	164
	500	159	176	266	176	405	177
	600	161	188	285	188	450	189
	700	164	200	306	200	490	202
	800	165	202	313	204	506	206
1000	400	188	300	484	332	810	392
	500	200	340	555	376	935	450
	600	214	380	625	422	1060	505
	700	223	412	690	460	1170	550
	800	228	436	700	490	1200	570
2000	400	265	535	885	550	1540	590
	500	294	615	1030	630	1790	685
	600	333	715	1165	740	2100	790
	700	357	775	1300	800	2260	855
	800	368	805	1350	830	2360	890
3000	400	358	780	1315	790	2270	815
	500	392	860	1460	875	2540	935
	600	435	965	1635	985	2840	1020
	700	486	1100	1850	1130	3230	1160
	800	518	1180	2000	1200	3460	1290

- \underline{VO}_x - Magnitude of deflection in the direction of the wind.
- \underline{VO}_y - Magnitude of deflection in the direction, perpendicular to the direction of the wind.

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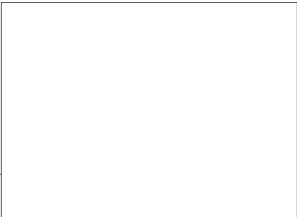
The depth of the spread of OV vapors with concentrations dangerous for personnel wearing gasmasks is determined by special tables. On the average, the vapors may spread to a depth of 1.5 to 2 km.

When the burst of an R-30 chemical missile occurs at a height of 400 meters and with a wind velocity at this height, in the area of the objective being destroyed, of 2 to 8 meters per second, the safe distance may be 4 to 6 km when the wind is in the direction of friendly troops, and 2 to 3 km when the wind is in the direction of the enemy.

In order to ensure safety, it is also necessary to notify the friendly troops in a timely manner of the time and place of delivery of chemical strikes. Continuous chemical reconnaissance of areas subjected to chemical strikes is carried out during the course of an offensive, in order to determine the level of contamination of the terrain by the moment when friendly troops reach these areas and to take appropriate measures for their protection.

In all cases the advancing troops must be supplied with reliable means of protection from destruction by the toxic chemical agents, in case they have to cross contaminated sectors.

The purpose of this article is to present the main fundamental principles of using chemical missiles. These principles should not, under any circumstances, be considered as firmly established, because they can be defined with greater precision as practical experience is accumulated.



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